

Klamath National Forest – Fisheries

Update to NMFS on Coho Critical Habitat conditions post July 2015 storm events

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This document, prepared as part of Emergency ESA Consultation, provides information related to July 2015 storm events on the KNF, emergency actions taken, the likely effects of these emergency actions on Coho salmon and designated Critical Habitat (CH), and a summary of the condition of Coho salmon CH at this time. This document by no means discusses all mass wasting and elevated flow events that have occurred post 2014 wildfires, it focuses on events of July 2015 that affected Coho salmon CH and is based upon the best available information at this time gathered as part of ongoing road storm patrols and resource specialist reconnaissance on the KNF.

In July and early August localized and intense thunderstorms occurred in several watersheds within the large footprint of 2014 wildfires, in many cases overlapping with heavily burned areas and steep slopes. The KNF Watershed staff produced a July 2015 Storm Report (August 2015) to summarize the storms and resultant debris flows, focusing on where Forest Service roads were affected and how BAER and other road stormproofing actions had performed in minimizing road failures and protecting water quality. Province Geologist Juan de la Fuente also produced a report to capture information gathered as part of recon efforts within the affected areas, as well as recommendations for actions and further assessments. These reports are included as attachments to this document. Coho CH streams at least somewhat affected by these natural events include:

- North Fork Salmon River, South Russian Creek, and Whites Gulch;
- Middle Klamath River, from Beaver Creek downstream;
- Beaver Creek;
- Walker Creek;
- Grider Creek; and
- Lower Scott River.

The Province Geologist, along with Engineering, Watershed, and Fisheries staff, tracked and reviewed in the field the areas most affected by these storm events and debris flows. Mr. de la Fuente captured the following general notes as part of field recon and evaluation:

Virtually all have been sediment bulking debris flows. These are triggered by rapid influx of water and surface erosion from steep slopes adjacent to channels and by mobilization of stream channel deposits. We saw no examples of road fill failures or landslides triggering debris flows. We saw no activated deep seated landslides.

Events and Actions Taken

North Fork Salmon River

Starting 7/5/15, intense thunderstorms occurred over localized areas in the Russian Wilderness which drain toward Highland Creek, Music Creek, South Russian Creek, and eventually North Fork Salmon River. These lands are largely underlain by granitic bedrock and situated within and uphill from steep areas affected by moderate and high intensity wildfires during 2014 Whites Fire.

The Province Geologist (Juan de la Fuente) captured the following notes:

Large debris flow in tributary to Highland Creek average 8' deep in a channel 20-30 feet wide and gradient of 45%. Blocked two legs of switchback [on 45N54]. This was a sediment bulking debris flow. Similar debris flows occurred in 1996 and 2003 in a small stream just east of this year's event. Extensive small fans deposited on road at channels and also between channels. Large culvert blocked on Music Creek and pond 200 feet long formed. The culvert was opened around July 14. Trailhead at end of road buried with debris by stream diversion down the road.

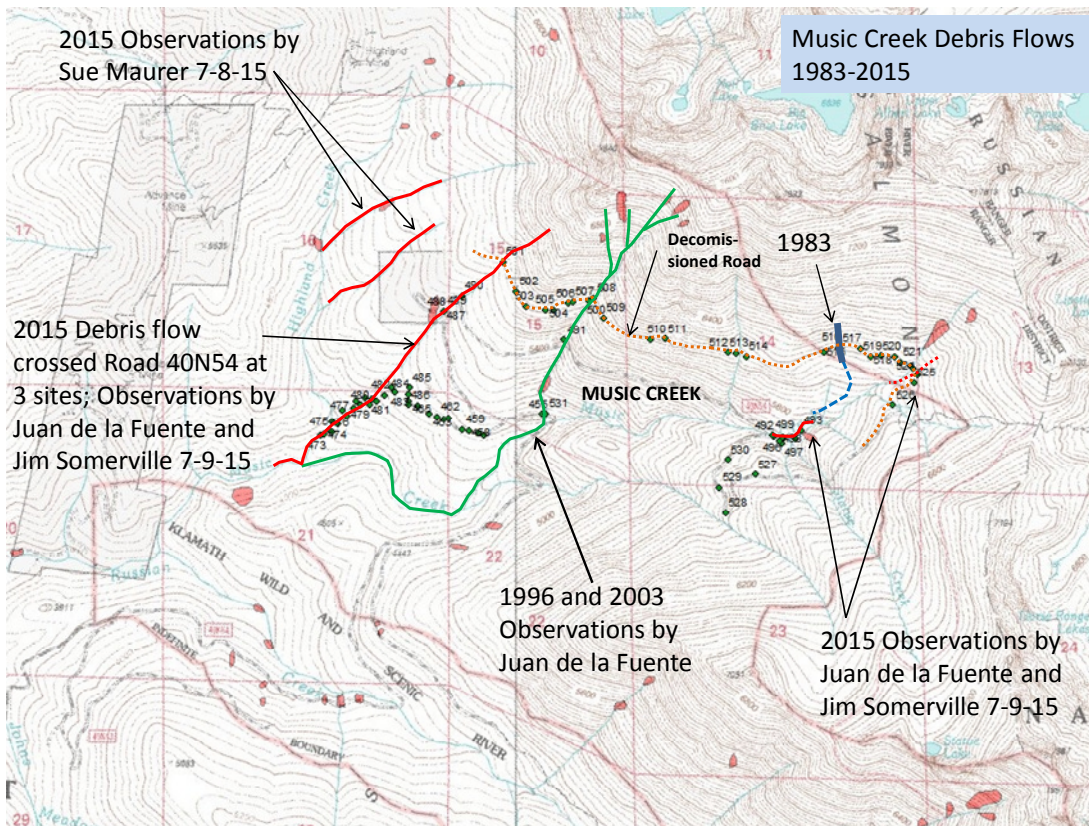


Figure 1. Map showing recent and several past debris flow events in Highland Creek area. Even more extensive debris flows occurred in this area in the 1964 flood event. Courtesy of Juan de la Fuente.

Emergency actions taken to address the situation included clearing roadways and reincorporating excess dirt/fill back into the road prism where possible and otherwise stockpiling the material (outside of Riparian Reserves). Recent BAER treatments on roads, such as rocked dips, were found to have performed very well. Armoring of fills at culvert outlets at stream crossings with large rip rap saved road fills from failure.



Figure 2. Debris flow deposit on 40N54, photo taken 7/8/2015.

At one site on South Russian Creek and one site on Highland Creek, instream work in a live stream was necessary to unplug blocked culverts and remove debris. Figure 3 displays where instream actions were necessary. At the site highest up on 40N54, the culvert was completely blocked and a large pond was forming and saturating the road fill (details in Geology report). Going down the road toward South Russian Creek, at the two sites where the road switches back, instream work was necessary but the channel was dry when the work was performed. The lowest site where instream action was needed is just above the upstream extent of Coho salmon CH in South Russian Creek. At this location, the crossing was partially blocked by debris flow and emergency actions involved removing debris from the culvert inlet and outlet and clearing the road way. During these emergency actions in live streams, flows were diverted around the site while work was performed.

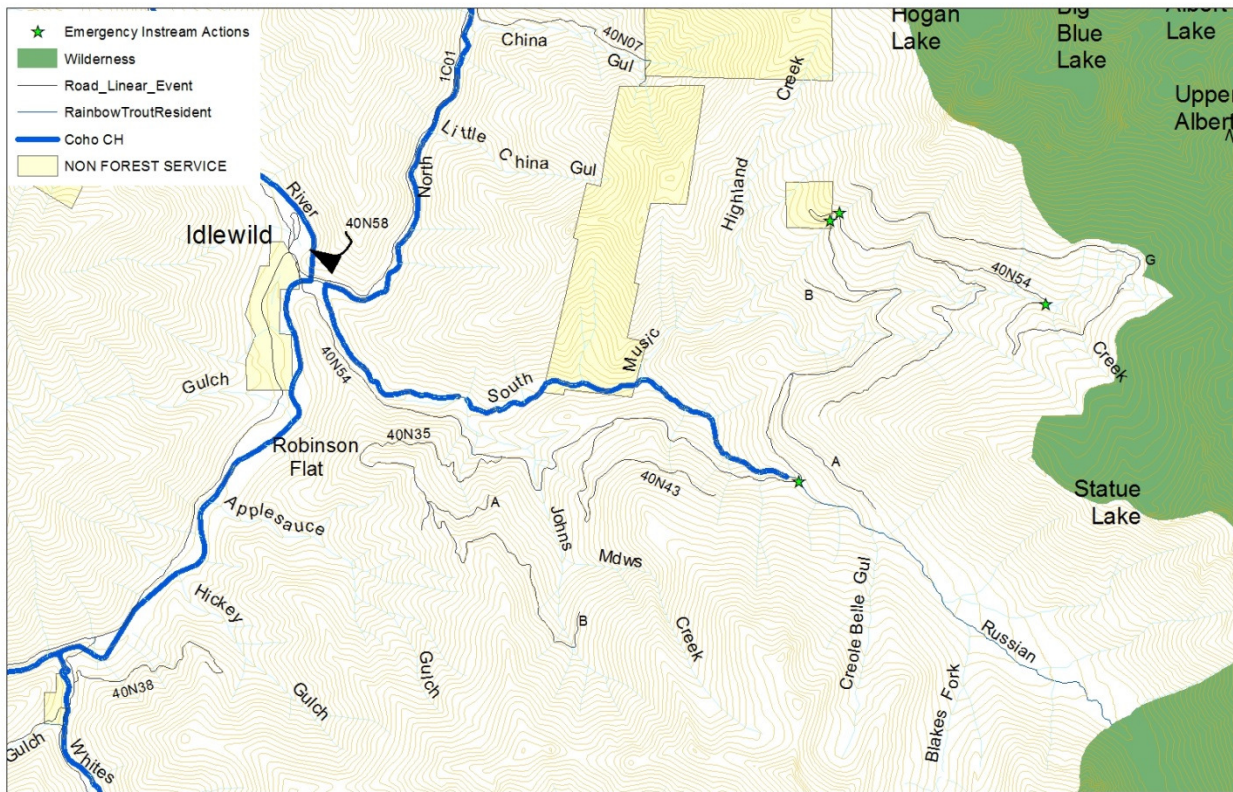


Figure 3. Location of instream emergency actions in Highland Creek/South Russian Creek area.

Middle Klamath River

Also during the first several weeks of July, significant precipitation events occurred over the Beaver Fire area, and the Happy Camp Fire area particularly in Walker and Grider Creeks.

Beaver Fire Area

Several tributaries to Beaver Creek, Fish Gulch and Marble Gulch, as well as several face drainages to the Klamath River near Beaver Creek experience accelerated erosion in the form of rilling, gullyng, and debris flows. Debris flows in Fish Gulch and Marble Gulch were relatively large events that moved large logs and rocks greater than 3 feet in diameter, and delivered sediment and large wood to lower Beaver Creek (and private roads and lands adjacent to Beaver Creek). Further upstream and on the east side of Beaver Creek, Buckhorn Gulch and Polly Gulch also experienced debris flows, these events did not involve roads but also contributed sediment and debris to Coho salmon CH in lower Beaver Creek.



Figure 4. Photo taken 7/21/15 from Beaver Creek County road looking up Marble Gulch. In July 2015, similar debris flow events occurred in many small gulches and tributaries to Beaver Creek and the Klamath River in the Beaver Fire area.

The Forest Service did not need to take emergency actions in the Beaver Creek area. Siskiyou County and Fruit Grower's Supply Company did take emergency actions to clear roadways along Beaver Creek and the Klamath River.

Happy Camp Fire Area- Walker Creek

Early in the week of July 6th, again due to intense precipitation over post fire areas, a significant debris flow event occurred in several drainages of Walker Creek, including East Walker Creek and several tributaries draining the west side of Walker Creek watershed. At the location of the first crossing of East Walker Creek when driving 46N64 from Highway 96, the debris flow blocked the culverts and swept over the road depositing debris on the roadway and below to the confluence with Walker Creek. This crossing, and the one above it on 46N65, were overtopped and clogged with large rocks, wood and sediment. The debris flow was about 8 feet deep as it traveled through its channel above the crossings, and it buried the crossings with about 1 foot of debris. These crossings were compromised but did not fail. Engineers estimated that approximately 5 cubic yards of road fill was lost at each crossing, and about 2000 cubic yards of sediment and debris had to be removed to recover and clear the crossing and road. Excess material was stockpiled at the large old landing near East Walker Creek (site #3 in figure below).

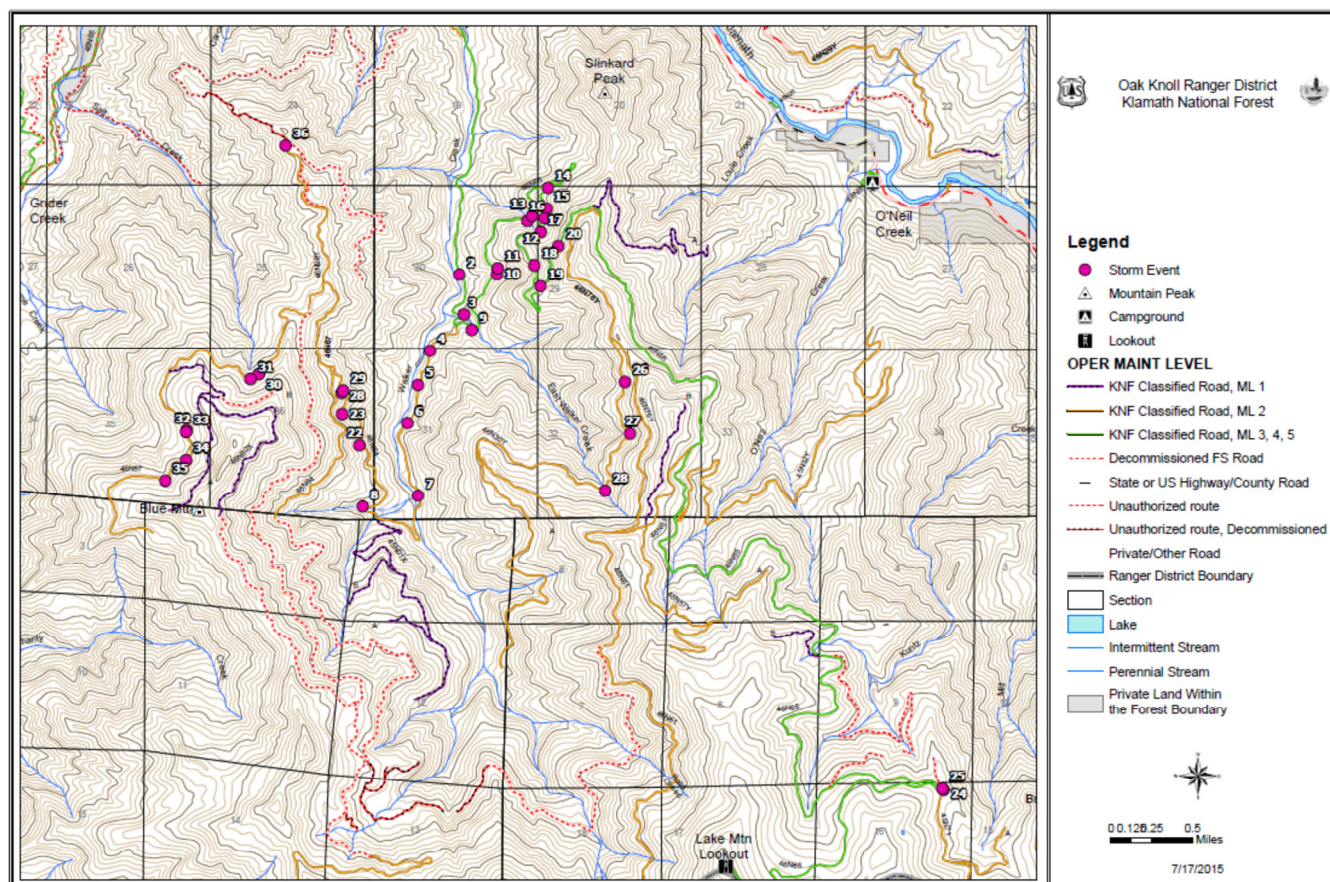


Figure 5. Map showing sites of emergency road repair in Walker Creek area.

Emergency actions in live streams were required at several sites on East Walker Creek; these sites are labeled as # 3 and 9 in Figure 5 above. On the west side of Walker Creek, emergency actions in live streams were required at sites #8 and 23. During these emergency actions in live streams, flows were diverted around the site while work was performed.

Happy Camp Fire Area- Grider Creek

Early in the week of July 6th, again due to intense precipitation over post fire areas, a significant debris flow event occurred in the No Name Creek drainage of lower Grider Creek. Field review confirmed the event was triggered near the top of the watershed by accelerated erosion, rilling and gullyng that channelized to a debris flow that swept downstream to the confluence of No Name Creek and Grider Creek, just upstream of the Grider Creek campground. The main No Name Creek channel was scoured to bedrock in many places, as the debris flow swept down through this mostly-unroaded drainage that was heavily burned in the 2014 Happy Camp Fire. The debris flow deposited a substantial amount of fine and coarse sediment to Grider Creek near the confluence with No Name Creek.



Figure 6. Upper No Name Creek drainage on 7/21/2015. Debris flow initiated above the road, near the top of the drainage, and can be seen in the middle left of this photo behind the burned trees in foreground.



Figure 7. Panoramic photo of confluence of No Name Creek and Grider Creek. Taken 7/21/2015.

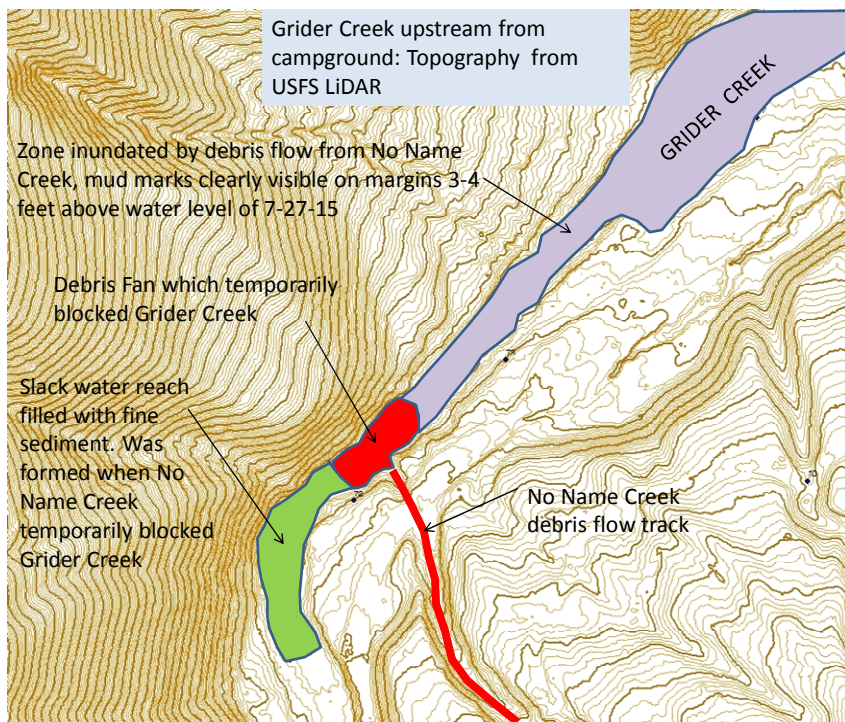


Figure 8. Schematic of debris flow deposition in Grider Creek. Courtesy of Juan dela Fuente.

Roads played little to no role in this debris flow event in Grider Creek. The Forest’s primary concern for infrastructure and public safety relates to the campground just downstream of No Name Creek confluence. The only emergency actions taken by the Forest Service in Grider Creek watershed in response to these events was near the top of No Name Creek drainage on road 40N67. Emergency repair/stabilization involved cleaning out culverts in dry channels and removing sediment and debris from roadways and stockpiling outside of Riparian Reserves.

Happy Camp Fire Area- Lower Scott River

Somewhat later, around August 5th, intense precipitation events occurred over burned areas in the lower Scott River, particularly the McGuffy Creek drainage. This localized intense precipitation event caused elevated flows and substantial turbidity in McGuffy Creek and the lower Scott River for several days. Engineering and geology staff conducted recon in the McGuffy Creek drainage and found evidence in the creek of the high water event but no evidence of debris flows where the creek crosses under the County road; riparian vegetation in lower McGuffy Creek survived this flood event intact. There was evidence of rilling above the road near the top of the drainage (45N65) that deposited small fans of sediment on the road; rocked dips on the road that were completed recently as part of BAER performed well as intended.

Effects of Emergency Actions Taken

The Forest Service took emergency actions to stabilize roads and infrastructure while protecting natural and cultural resources. The Forest Service did not take actions within Coho salmon CH. As described above, emergency actions required work in live streams at the following locations:

- South Russian Creek – closest proximity of emergency work was approximately 400 feet upstream of the current mapped extent of Coho salmon CH; and
- Walker Creek – closest proximity of emergency work was approximately 800 feet upstream of the current mapped extent of Coho salmon CH.

Although these actions occurred in relatively close to Coho salmon CH, it is unlikely that Coho salmon were present in these creeks at the time of the storm event and fish certainly were not present or in close proximity downstream during the emergency actions. Even after intensive surveys during the largest coho brood year in summer 2014, the Forest has yet to observe Coho salmon juveniles in South Russian Creek. Coho salmon juveniles have been found in the lowest mile of mainstem Walker Creek so they may have been present there when the storms occurred (there is a possible natural barrier to passage at 1.5 miles from the confluence with the Klamath River, Coho salmon have not been observed above this barrier). At the time emergency work was undertaken in East Walker Creek, Coho salmon were mostly likely greater than 2 miles downstream in lower Walker Creek or downstream. The potential effects of the emergency actions taken would be a minor pulse of additional sediment in the creeks where actions occurred. The contribution of these sediment inputs to the post-debris flow habitat conditions in South Russian Creek/North Fork Salmon River, and Walker Creek, is minor and discountable.

Updated Coho Salmon CH Conditions

The following environmental baseline checklists are provided to summarize the post-July 2015 storm event conditions of Coho salmon CH on the Klamath National Forest. These updates were prepared using the baseline checklists provided in Appendix D of the April 2015 Westside Fire Recovery Biological Assessment; updated information is highlighted below with red text. For information cited in these checklists that is not being updated, please refer to the Biological Assessment Appendix D.

The information provided below summarizes the current condition of Coho salmon Critical Habitat indicators in areas affected by July 2015 storm events and in watersheds where instream emergency actions were necessary; the Forest Service did not need to take emergency actions within Coho salmon CH. These habitat conditions are continually changing and heavily dependent upon weather and storm patterns. Current habitat conditions are related to widespread post fire conditions across many watersheds of the Klamath Mountains; these areas will generally recover over time – although additional disturbances from near term storm events and future wildfires and storms will continue to change and shape the condition of fish habitat over time.

PJ: Professional judgment of Forest Service fisheries biologists

PO: Personal observations by Forest Service fisheries biologists

**Table of Pathway and Indicators for 7th Field Watershed
Lower South Russian Creek**

<u>DIAGNOSTIC OR PATHWAY and INDICATOR</u>	Environmental Baseline		
	PROPERLY FUNCTIONING	FUNCTIONING - AT RISK	NOT PROP. FUNCT.
<u>Habitat Quality</u> Temperature	WQ 2012; WA 1995; Temps-SRussian		
Suspended Sediment - Intergravel DO/Turbidity ¹	PJ, CWE 2015; Sed 2013 (long-term)	PO-Fire (short-term)	
Chemical Contamination/ Nutrients	PJ		
<u>Habitat Access</u> Physical Barriers ²		PJ; CDFW 2015; FishPass 2001; SRussian1980	
<u>Habitat Elements</u> Substrate Character and Embeddedness ¹	CWE 2015; Sed 2013 (long-term)	PO-Fire (short-term)	
Large Woody Debris			Coho 2014; WA 1995
Pool Frequency and Quality		PJ; SRussian 1994	
Large Pools			
Off-channel Habitat	PJ		
Refugia¹		PJ (short-term)	
<u>Channel Cond & Dyn</u> Average Wetted Width/Maximum Depth		PJ; SRussian 1994	
Streambank Condition		PJ (short-term)	
Floodplain Connectivity	PJ		
<u>Flow/Hydrology</u> Change in Peak/Base Flows ¹	PJ; CWE 2015; Coho 2014 (long-term)	PJ, BAER (short-term)	
Increase in Drainage Network		PJ	
<u>Watershed Conditions</u> Road Density & Location ³	GIS (Upper S. Rus)		SRSS 2002; WA 1995; GIS (Lower S. Rus.)
Disturbance History & Regime	PJ; CWE 2015 (Upper S. Rus.)	PJ; Coho 2014; WA 1995 (Lower S. Rus.)	
Riparian Reserves - Northwest Forest Plan ¹		PO-Fire; PJ; BAER; Coho 2014; WA 1995	

¹These Indicators are affected due to post fire conditions, current conditions are expected to be short term and return to more typical condition within a year or two depending on weather and stochastic events. Other fire-affected Indicators, such as Riparian Reserves, will take longer to recover, and the new "current condition" will likely persist for many years.

²Although various databases do not identify any passage barriers, a potential barrier is present on private property downstream of Music Creek in the form of an historic dam atop a bedrock fall/chute which used to divert water to a small hydropower plant (Pers. Obs. - M. Meneks; SRussian 1980). Degree of passage restriction unknown.

Large Woody Debris

In 2015, following the post-fire debris flow from Music/Highland Creek drainages, the District Fish Biologist examined about 0.3 miles of South Russian Creek downstream of the Music Creek confluence. Recently deposited large wood was observed as a byproduct of the event. Furthermore, the Fish Biologist observed where large, fire-weakened trees have recruited to the creek. The addition of new wood to a creek is an expected, positive benefit of fire. However, given the overall deficient nature of the system, it is unlikely to be sufficient to increase the existing baseline condition of the stream.

Pool Frequency and Quality

Following the 2014 Whites Fire and debris flow, changes to the pool Indicator may occur, particularly in the Lower South Russian 7th-field watershed. Pool quality (depth) is especially of interest as many pools downstream of the Music Creek confluence and within the area of impact from the debris flow have been visibly in-filled to a greater or lesser degree by sands and silts. However, the system is in flux, and it may be several years before a new baseline is established. It is the professional judgement of the District Fish Biologist that the pools Indicator should retain the “Functioning-At-Risk” status. The elevated amount of sediment currently moving through South Russian Creek below Music Creek is expected to be short-term (see “Substrate Character” discussion). Excess sediment is expected to be flushed from the system this winter; and as the system, especially the Music/Highland Creek tributary system, revegetates and stabilizes over the next few years, input sediment affecting pools will return to a more normal rate. If the alteration to substrate regime persists for several years past the time when the fire area should start to stabilize and continues to impact elements such as pool frequency/quality, then this Indicator will be re-evaluated. Forest monitoring scheduled to occur in regards to substrate also includes a fines-in-pool-volume component which will assist in tracking pool recovery.

Refugia

The current condition is influenced by the post fire environment and is expected to be relatively short-term, with watershed response to precipitation events going back to pre-fire baseline conditions within a year or two as revegetation occurs and soils stabilize. For some Indicators, like Riparian Reserves, recovery of pre-fire conditions will take longer. At this time, it is the professional judgement of the Fish Biologist that while individual Indicators may not be sufficiently degraded to warrant downgrading, the cumulative effects to refugia suggests a temporary change to “Functioning-At-Risk”. Another year or two is needed before a conclusive determination can be made concerning need to change the long-term baseline to “Functioning-At-Risk”, or return it to its long-term “Properly Functioning” status.

Due to July 2015 debris flow, there was an observable increase in turbidity and deposition of finer – sand and silt - sediment that persists in South Russian Creek. Elevated turbidity was observed in the mainstem North Fork Salmon River for nearly 20 miles, from the mouth of North Russian Creek to the Forks of Salmon; and beyond to the main Salmon River. The debris flow was the result of a summer thunderstorm stalling over a high intensity burned area. Two previous precipitation events were observed following higher intensity fall/winter storms, whereupon lower South Russian Creek below the Music Creek confluence was noticeably more turbid than upper South Russian Creek or nearby systems such as North Russian Creek. However, the impact of these events was not of the same magnitude as the 2015 debris flow. Other precipitation events may have caused a noticeable increase in fine sediment or turbidity, but they were not observed by or reported to the Forest Service.

Due to the mobilization and accumulation of fine sediment, the short-term baseline condition following the fire is considered to be “Functioning-At-Risk” for South Russian 7th-field watersheds. The long-term effect of sediment mobilization, especially in regard to lower South Russian Creek below the Music Creek confluence, is not entirely clear at this point. Another year or two, with the seasonally expected increase in discharge and regrowth of stabilizing vegetation on the burned areas, is needed before a conclusive determination can be made concerning need to change the long-term baseline to “Functioning-At-Risk”, or return it to the long-term “Properly Functioning” status. Post-fire sediment monitoring will contribute towards the understanding of the long term trend of fish habitat condition in South Russian Creek. If the alteration to substrate composition persists for several years, past the time when the fire area should start to stabilize, then this Indicator should be re-evaluated.

**Table of Pathway and Indicators for 7th Field Watershed
Whites Gulch**

<u>DIAGNOSTIC OR PATHWAY</u> and INDICATOR	Environmental Baseline		
	PROPERLY FUNCTIONING	FUNCTIONING - AT RISK	NOT PROP. FUNCT.
<u>Habitat Quality</u> Temperature	WQ 2012; WA 1995; Temps-Whites		
Suspended Sediment - Intergravel DO/Turbidity ¹	PJ, CWE 2015; Sed 2013; Whites 2006 (long-term)	PO-Fire (short-term)	
Chemical Contamination/ Nutrients	PJ		
<u>Habitat Access</u> Physical Barriers ²	PJ, CDFW 2015; Siskiyou 2002; FishPass 2001		
<u>Habitat Elements</u> Substrate Character and Embeddedness ¹	CWE 2015; Sed 2013; Whites 2006	PO-Fire (short-term)	
Large Woody Debris			Whites 2006; WA 1995
Pool Frequency and Quality	Whites 2006		
Large Pools			
Off-channel Habitat	N/A - Not present		
Refugia ¹		PJ (short-term)	
<u>Channel Cond & Dyn</u> Average Wetted Width/Maximum Depth		PJ, Whites 2006	
Streambank Condition		PJ	
Floodplain Connectivity	PJ		
<u>Flow/Hydrology</u> Change in Peak/Base Flows ¹	PJ; CWE 2015; Coho 2014 (long-term)	PJ, BAER (short-term)	
Increase in Drainage Network		PJ	
<u>Watershed Conditions</u> Road Density & Location		SRSS 2002; GIS	
Disturbance History & Regime		PJ; Coho 2014; WA 1995	
Riparian Reserves - Northwest Forest Plan ¹		PO-Fire; PJ; BAER; Coho 2014; WA 1995	

¹These Indicators are affected due to post fire conditions, current conditions are expected to be short term and return to more typical condition within a year or two depending on weather and stochastic events. Other fire-affected Indicators, such as Riparian Reserves, will take longer to recover, and the new "current condition" will likely persist for many years.

²Although various databases do not identify any passage barriers, a potential barrier is present on private property downstream of Music Creek in the form of an historic dam atop a bedrock fall/chute which used to divert water to a small hydropower plant (Pers. Obs. - M. Meneks; SRussian 1980). Degree of passage restriction unknown.

Suspended Sediment - Intergravel DO/Turbidity

The District Fish Biologist observed response of Whites Gulch following the 2014 Whites Fire and subsequent precipitation events. Due to suspected landslides or other sediment mobilization in East Fork Whites Gulch, which was heavily burned in 2014, Whites Gulch experienced at least three bouts of elevated turbidity and increased deposition of finer – sand and silt – substrate. These events followed (1) higher intensity fall/winter storms, and (2) a summer thunderstorm which stalled over the burned area in July 2015. The ensuing elevated turbidity in Whites Gulch had cleared in less than six days. The indicator remains “Functioning At Risk” post July 2015 storm events.

Refugia

Post 2014 Whites Fire and July 2015 storm events, there is temporary and localized degradation in some Indicators which contribute to Refugia. Most fire-related degradation is expected to be short-term, with conditions similar to pre-fire baseline within a year or two as revegetation occurs and soils stabilize, although some Indicators, like Riparian Reserves, are likely to take longer. At this time, it is the professional judgement of the Fish Biologist that while individual Indicators may not be sufficiently degraded to warrant downgrading, the cumulative effects to refugia suggests a temporary change to “Functioning-At-Risk”. Another year or two is needed before a conclusive determination can be made concerning need to change the long-term baseline to “Functioning-At-Risk”, or return it to its long-term “Properly Functioning” status.

Average Wetted Width/Maximum Depth

It is known that an increase in sediment influx from East Fork Whites Gulch has occurred and is temporarily impacting channel morphology and thus the width-to-depth ratio within Coho salmon CH reaches in lower Whites Gulch. These habitat conditions are expected to be temporary and will recover over time as soils and vegetation recover. It is the professional judgement of the District Fish Biologist that the width-to-depth Indicator retains its “Functioning At Risk” baseline. The elevated fine sediment conditions will persist through the base flow period but is expected to be flushed from the system this winter and habitat conditions to return to general pre-storm conditions and trends.

**Table of Pathway and Indicators for 5th Field Watershed
North Fork Salmon River**

DIAGNOSTIC OR PATHWAY and INDICATOR	Environmental Baseline		
	PROPERLY FUNCTIONING	FUNCTIONING - AT RISK	NOT PROP. FUNCT.
<u>Habitat Quality</u> Temperature		Coho 2014; SRCA 1998; WA 1995	
Suspended Sediment - Intergravel DO/Turbidity ¹	CWE 2015; WA 1995	PO; PJ (short-term)	
Chemical Contamination/ Nutrients	CA-EPA		
<u>Habitat Access</u> Physical Barriers	CDFW 2015; Coho 2014; Siskiyou 2002; FishPass 2001		
<u>Habitat Elements</u> Substrate Character and Embeddedness ¹		PJ; SRCA 1998; WA 1995; NFSal 1989	
Large Woody Debris			Coho 2014; SRCA 1998; WA 1995
Pool Frequency and Quality		SRCA 1998; WA 1995	
Large Pools			
Off-channel Habitat		PJ; Coho 2014	
Refugia¹		PJ (short-term)	
<u>Channel Cond & Dyn</u> Average Wetted Width/Maximum Depth	PJ; CWE 2015		
Streambank Condition	ND - likely Properly Functioning (PJ)		
Floodplain Connectivity	PJ, Coho 2014		
<u>Flow/Hydrology</u> Change in Peak/Base Flows	PJ; CWE 2015; Coho 2014		
Increase in Drainage Network	PJ; CWE 2015		
<u>Watershed Conditions</u> Road Density & Location	CWE 2015; SRSS 2002		
Disturbance History & Regime	PJ; CWE 2015; WA 1995		
Riparian Reserves - Northwest Forest Plan ¹		PJ; Coho 2014; WA 1995	

¹These Indicators are affected due to post fire conditions, current conditions are expected to be short term and return to more typical condition within a year or two depending on weather and stochastic events. Other fire-affected Indicators, such as Riparian Reserves, will take longer to recover, and the new "current condition" will likely persist for many years.

Suspended Sediment - Intergravel DO/Turbidity

The July 2015 debris flow event in the Music/Highland Creek drainage caused an extended period of turbidity in the North Fork Salmon River. This event was due to an intense thunderstorm stalling over an area of high burn intensity which occurred during the 2014 Whites Fire. Subsequent investigations found wide-spread rilling accompanied by

generalized channel scour and debris flows in several drainages of South Russian Creek and Whites Gulch. Output from the debris, primarily in the form of turbidity and fine sediment, eventually affected nearly 20 miles of the North Fork Salmon River mainstem. Several weeks passed before the water has somewhat cleared; and a noticeable amount of silt was left behind as drought-influenced base flow discharge has been insufficient to move the fines through the system. Turbidity events due to rain events originated from East Fork Whites Gulch on at least three occasions, although their duration was much less than in South Russian and little to no fine sediment deposits were observed.

Post-fire erosion and debris flows have caused a degradation in turbidity Indicator, it is considered to be a short-term change in the condition to a “Functioning-At-Risk” status. Normal conditions are expected to return in a year or two as areas with high burn severity revegetate and provide soil stabilization. On the larger landscape of the 5th-field watershed, these high burn severity areas are small, and it was by chance that intense summer thunderstorms formed overhead and stalled. If bouts of extended turbidity persist for several years, past the time when the fire area should start to stabilize, then this Indicator should be revisited in regards to its baseline condition.

Substrate Character

The addition of fire impacts from 2013 and 2014 has degraded habitat conditions in the mainstem North Fork Salmon River, but it is insufficient to downgrade to “Not Properly Functioning”. The fire impacts are considered a temporary condition, one which may last a number of years, but which must also be considered on the larger 5th-field scale. Sediment input following the 2013 fire appears to have decreased following the initial winter, and continues to be localized in nature with a minimum of silts. Conversely, the long-term effect of 2014 fires is not entirely clear at this point. Timing is a big factor in 2014 fire impacts - summer thunderstorms at baseflow versus elevated discharge of winter. While the latter sweeps fines from the system, baseflow has insufficient power to do so, leaving behind the currently observed silt that will persist until bankfull flow events. Another year or two, with the seasonally expected increase in discharge and regrowth of stabilizing vegetation on the burned areas, is needed before a conclusive determination can be made concerning need to downgrade the system beyond “Functioning-At-Risk” in regards to sediment composition.

Pool Frequency and Quality

Currently an elevated amount of sediment is moving through the system, but this condition is expected to be temporary. In the meantime, pools have been observed to be collecting fine sediments, especially following the July 2015 Music/Highland Creek debris flow, but it is not of the degree that will decrease the number of deep “primary pools” already present. This sediment is expected to be flushed from the system in this winter; and as tributary systems revegetated and stabilize over the next few years, input sediment will return to its normal rate.

Refugia

Post 2014 Whites Fire and July 2015 storm events, there may be some temporary degradation in some Indicators which contribute to Refugia. While turbidity may drop from “Properly Functioning” to “Functioning-At-Risk”, other Indicators – Riparian Reserves, pool quality/quantity, etc. – are not expected to suffer sufficient impact to downgrade their current condition. Most fire-related degradation is expected to be short-term, with conditions similar to pre-fire baseline within a year or two as revegetation occurs and soils stabilize, although some Indicators, like Riparian Reserves, are likely to take longer. At this time, it is the professional judgement of the Fish Biologist that while individual Indicators may not be sufficiently degraded to warrant downgrading, the cumulative effects to refugia suggests a temporary change to “Functioning-At-Risk”. Another year or two is needed before a conclusive determination can be made concerning need to change the long-term baseline to “Functioning-At-Risk”, or return it to its long-term “Properly Functioning” status.

Table of Pathway and Indicators for 7th Field Watershed Buckhorn-Beaver Creek

Following July 2015 storm events, fisheries staff investigated Coho salmon habitat conditions in lower Beaver Creek and found that there is no need to update the baseline checklist provided in Appendix D of the Westside Fire Recovery Fisheries BA. The habitat indicators affected by recent storms were already rated as “Not Properly Functioning” or “At Risk”, and these overall ratings are still representative of conditions. Following are indicator-specific discussions related to current condition of Coho salmon CH in lower Beaver Creek.

Temperature

July 2015 thunderstorms triggered large debris flows in the Marble Gulch and Fish Gulch tributaries and smaller but notable debris flows in some of the other tributaries or draws (Buckhorn and Polly Gulches). These debris flows removed shallowed and widened the channels of Marble and Fish Gulches and delivered excess sediment to the lower few miles of mainstem Beaver Creek - particularly the lower 1.3 miles downstream of Fish and Marble Gulches. These disturbances are likely to result in greater rate of heating and cooling due to decreased average water depth and increased surface area to volume. Indicator remains At-Risk.

Suspended Sediment - Intergravel DO/Turbidity

Much of the excess sediment that was delivered to mainstem Beaver Creek is composed of gravel, sand, silt, ash and other fines. High turbidity was associated with the July 2015 debris flow event and high turbidity will persist throughout base flows as the creek incises through the excess sediment that was delivered and winnows out the fines: this could take as short a time as several high mainstem flows or could take years depending on (1) the size of peak flows that occur in the next few years and (2) the amount of new excess sediment that is delivered to mainstem Beaver Creek during those higher peak flows. In the short term, before ground cover recovers, turbidity will be increased during moderate to heavy rainstorms due to increased rate of surface erosion on moderate to severely burned ground. It is likely that there will be additional fire-related sediment bulking debris flows and possibly deep-seated landslides that will keep delivering excess sediment to the mainstem and delay recovery of water clarity. Indicator remains Not Properly Functioning.

Substrate Character

Post 2014 Beaver Fire water quality and sediment conditions in lower mainstem Beaver Creek and lower West Fork Beaver Creek were observed and photographed in the winter after several light to moderate precipitation events: the observations and photographs revealed that (1) turbidity was very high during and long- after precipitation events and (2) large quantities of fine sediment had been delivered to the mainstem which had partially smothered the pre-Fire streambed and salmonid spawning gravels. The 2014 Fire increased the actual rate of surface erosion as well as the modeled rate of surface erosion to well over threshold (USLE = 1.16). Increase in the frequency, magnitude and duration of turbidity due to increased surface erosion due to the 2014 Beaver Fire is likely last for a few years to a decade or more until vegetation gets re-established and ground cover is largely recovered in burned areas. Modeled mass-wasting is over threshold (GEO = 1.07). The high rate of mass wasting that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots.

Thunderstorms in July 2015 rained hard on ground that was burned at moderate to high intensity in the 2014 Beaver Fire. Debris flows in Fish, Marble, Buckhorn, and Polly gulches delivered excess sediment to the lower few miles of mainstem Beaver Creek - particularly the lowest 1.3 miles of Beaver Creek. Much of the excess sediment that was delivered to mainstem Beaver Creek is composed of sand, silt, ash and other fines. It is likely that there will be additional 2014 fire-related sediment bulking debris flows and possibly deep-seated landslides that will keep delivering

excess sediment including excess fines to the mainstem. Much of the streambed is covered with a layer of fine sediment. Indicator remains Not Properly Functioning.

Pool Frequency and Quality

Currently pool quality in lower Beaver Creek is reduced due to approximately 2-4 inches of fine sediment overlaying stream substrates in most pools. Pool depth/volume will continue to be compromised until bankfull flow events are able to flush excess fine sediments from Beaver Creek. Indicator remains Not Properly Functioning.

**Table of Pathway and Indicators for 7th Field Watershed
Walker Creek**

Diagnostic or Pathway and Indicator	Properly Functioning	At Risk	Not Properly Functioning
<u>Water Quality</u> Temperature		TEMP	
Sediment-Turbidity			SS07/08 KNF CWE PO PJ
Chemical Contamination	ND/PJ		
<u>Habitat Access</u> Physical Barrier	FPI		
<u>Habitat Elements</u> Substrate Character			SS07/08 KNF CWE PO PJ
Large Woody Debris			SS07/08
Pool Frequency/Quality			2015 Recon
Off-channel Habitat		PO	
Refugia		TEMP SS07/08	
<u>Channel Cond & Dvn</u> Width/Depth Ratio			Flood SS07/08
Streambank Condition			SS07/08 Flood KNF GIS
Floodplain Condition		PO	
<u>Flow /Hydrology</u> Change in Peak/Base Flow			KNF GIS RSS
Drainage Network Increase		KNF GIS RSS	
<u>Watershed Cond.</u> Road Density/Location			KNF GIS
Disturbance History/Regime			KNF GIS Flood
Riparian Reserves			KNF GIS Flood

Pool Frequency and Quality

Intense July 2015 thunderstorms on ground that burned at moderate to high intensity in 2014 triggered a major sediment bulking debris flow in East Fork Walker Creek and smaller but notable debris flows in some other tributaries or

draws. These debris flows aggraded the lower 2.5 miles of mainstem Walker Creek partially or completely infilling pools with excess sediment and leaving a lens of sediment on top of the former streambed. The most impacted fish-bearing reach is at, and downstream of, the confluence of East Walker Creek with mainstem Walker Creek. Although affected by tributary debris flows, the most upstream end of Coho salmon CH in Walker Creek was not substantially impacted. **Not Properly Functioning.**

**Table of Pathway and Indicators for 7th Field Watershed
Lower Grider Creek**

Diagnostic or Pathway and Indicator	Properly Functioning	At Risk	Not Properly Functioning
<u>Water Quality</u> Temperature		TEMP	
Sediment-Turbidity			SS1998 2014Recon
Chemical Contamination	ND/PJ		
<u>Habitat Access</u> Physical Barrier	FPI		
<u>Habitat Elements</u> Substrate			SS1998 2014Recon
LWD		SS1998 2014 Recon PJ	
Pool Frequency/Quality			2015Recon
Off-channel Habitat		KNF GIS PJ	
Refugia		TEMP PJ	
<u>Channel Cond & Dyn</u> Width/Depth Ratio			2015Recon
Streambank Condition		Flood 2014 Fire	
Floodplain Condition		PJ	
<u>Flow /Hydrology</u> Peak/Base Flow		KNF-GIS RSS	
Drainage Network Increase		KNF-GIS RSS	
<u>Watershed Condition</u> Road Density/Location		KNF-GIS Flood	
Disturbance History/Regime			KNF-GIS Flood 2014 Fire
Riparian Reserves			KNF-GIS Flood 2014 Fire

Pool Frequency and Quality:

July 2015 thunderstorms triggered a major debris flow in No Name Creek that resulted in massive aggradation of the lower three miles of mainstem Grider Creek. Much of the excess sediment that was delivered to mainstem Grider Creek

is composed of sand, silt, ash and other fines although particles up to the size of small boulders are included in the mix. The debris flow resulted in aggradation of the lower three miles of mainstem Grider Creek completely infilling most mainstem pools with excess sediment and leaving a thick lens of sediment on top of the former streambed. High turbidity was associated with the July 2015 debris flow event and high turbidity will persist as the creek incises through the sediment lens that was deposited and winnows out the fines: this could take as short a time as several high mainstem flows or could take years depending on (1) the size of peak flows that occur in the next few years and (2) the amount of new excess sediment that is delivered to the mainstem during those higher peak flow events. It is likely that there will be additional fire-related sediment bulking debris flows as well as deep-seated landslides and landslide-related debris flows for ten years or longer that will keep delivering excess sediment to the mainstem and delay recovery of water clarity and pool quality. **Not Properly Functioning.**

Width/Depth Ratio:

The massive debris flow in July 2015 aggraded the lower three miles of mainstem Grider Creek completely infilling most mainstem pools with excess sediment and leaving a thick lens of sediment on top of the former streambed that significantly increased the channel width-to-depth ratio. **Not Properly Functioning.**